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AN X-RAY STUDY OF GRAIN EVOLUTION BEHIND NON-RADIATIVE SHOCK

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In Vancura et al. [1994, Ap.J., 442,680 (Attachment A)], the dusty shock model and specific predictions applicable to the ROSAT Cygnus Loop data were described. More recently, in Slane, Vancura, and Hughes [1996, Ap.J., in press (Attachment B)], they successfully applied predictions of the dusty shock code in an analysis of the new remnant G299.2-2.9.

At the September 1995 Wurzburg conference, **Roentgenstrahlung from the Universe**, Drs. Vancura and Raymond presented results of the ROSAT data on the Cygnus Loop (*A Study of Dusty Nonradiative Shock Waves*). They confirmed that a proper analysis of the data will require updating the shock code to include an adiabatic treatment of the primary shock in this supernova remnant. Presently Dr. Vancura and collaborators are updating the code to do this. After which, they anticipate being able to analyze, in detail, data on the Cygnus Loop and Puppis A.

> **Wurzburg Abstract**:- Using ROSAT PSPC and IRAS data, we present an analysis of grain evolution behind nonradiative shock waves in the Cygnus Loop and Puppis A supernova remnants. We have constructed a dynamic theoretical model of grain evolution through nonradiative shocks. We make specific predictions about the x-ray spectrum emanating from a postshock plasma, as well as thermal IR emissions due to grain heating. Our predictions have agreed favorably with previous x-ray and IR luminosity observations. Both the Cygnus Loop and Puppis A, by virtue of coincident IR and x-ray enhancements, are prime candidates for postshock grain heating via thermal collisions and grain destruction by thermal sputtering. Here, in addition to testing our model predictions on the spectral shape and magnitude of the x-ray and far IR emissions, we discuss the blast wave/ISM interaction and evolution, evolutionary effects of grains passing through the postshock plasma, and the effects of varying physical conditions between the remnants.

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Title: A study of X-ray and infrared emissions from dusty nonradiative shock waves

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Abstract

We have constructed models that predict the dynamic evolution and infrared (IR) emission of grains behind nonradiative shock waves. We present a self-consistent treatment of the effect of grain destruction and heating on the ionization structure and X-ray emission of the postshock gas. Incorporating thermal sputtering, collisional heating, and deceleration of grains in the postshock flow, we predict the IR and X-ray fluxes from the dusty plasma as a function of swept-up column density. Heavy elements such as C, O, Mg, S, Si and Fe are initially depleted from the gas phase but are gradually returned as the grains are destroyed. The injected neutral atoms require some time to 'catch up' with the ionization state of the ambient gas. The nonequilibrium ionization state and gradient in elemental abundances in the postshock flow produces characteristic X-ray signatures that can be related to the age of the shock and amount of grain destruction. We study the effects of preshock density and shock velocity on the X-ray and IR emission from the shock. We show that the effects of graindestruction on the X-ray spectra of shock waves are substantial. In particular, temperatures derived from X-ray spectra of middle-aged remnants are likely to be overestimated by approximately 15% if cosmic abundances are assumed.

Due to the long timescales for grain destruction in X-ray gases over a wide range of temperatures, we suggest that future X-ray spectra studies of supernova remnants be based on depleted abundances instead of cosmic abundances. Our model predictions agree reasonably well with IRAS and Einstein IPC observations of the Cygnus Loop.

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Title:	A Study of the Evolutionary State of the Supernova Remnant G299.2-2.9
Authors:	SLANE, PATRICK; VANCURA, OLAF; HUGHES, JOHN P.
Journal:	Astrophysical Journal v.465, p.840
Publication Date:	07/1996
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